REMARKS

Claims 1-46 are pending in the present Application. Claims 1-36 have been withdrawn from consideration. No claims have been canceled, Claim 37 has been amended, and no claims have been added, leaving Claims 37-46 for consideration upon entry of the present Amendment.

Claim 37 has been amended to correct its dependency from withdrawn claims 1-36. Support for this amendment can at least be found in Claim 37 as originally filed as well as in Paragraphs [0030]-[0031] as originally filed.

No new matter has been introduced by these amendments. Reconsideration and allowance of the claims are respectfully requested in view of the above amendments and the following remarks.

Amendment To The Specification

The Cross-Reference To Related Applications has been amended to correct a typographical error in the provisional application filing date. The filing date for U.S. Provisional Application Serial No. 60/376,138 was changed from "April 26, 2002" to "April 29, 2002."

Objections

Claim 37 is objected to because of the following informalities: Claim 37 depends from non-elected claims 1-36. Claim 37, as presently amended, no longer depends from claims 1-36.

Claims 40-42 are objected to under 37 CFT § 1.75(c), as being of improper dependent form for allegedly failing to further limit the subject matter of a previous claim. In making the objection, the Examiner has stated that independent claim 38 requires that

> [T]he particle be of chains of lengths from about 5 nm to about 400 nm. Claims 40-42 fail to further limit as ranges specified therein begin at about 1 nm, which size is not encompassed by claim 38.

Applicants respectfully submit that the Examiner appears to have misinterpreted the claims. Claim 38 claims silica particles in the form of chains having lengths of about 5 to about 400 nanometers. Claim 38 is therefore directed to chains of silica particles wherein the chains have a length of about 5 to about 400 nanometers. Claims 40-42, on the other hand, are directed to the diameters of the individual silica particles. Claim 40, for example, claims "silica particles having diameters of about 1 to about 50 nanometers." Therefore, claims 40-42 further limit the subject matter claimed in claim 38. Applicants respectfully submit that claims 40-42 satisfy the requirements of 37 CFR § 175(c) because claims 40-42 further limit the subject matter of claim 38.

Double Patenting

Claims 37-40 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 3 and 7 of U.S. Patent No. 6,417,246.

Applicants respectfully request that the Examiner hold the obviousness-type double patenting rejections until the claims are in final form and otherwise in condition for allowance.

Claim Rejections Under 35 U.S.C. § 112, Second Paragraph

Claim 44 stands rejected under 35 U.S.C. § 112, second paragraph. Claim 44 has been amended to depend from claim 43 rather than claim 38. Applicants submit that the limitation "a silane surface treatment" in claim 43 provides proper antecedent basis for the limitation "the silane" in claim 44.

Reconsideration and withdrawal of this rejection are respectfully requested.

Claim Rejections Under 35 U.S.C. §§ 102(b), 102(e), and 103(a)

Claims 37-46 are rejected under 35 U.S.C. § 102(b) or § 102(e) as being allegedly anticipated by, or in the alternative, under 35 U.S.C. § 103(a) as allegedly obvious over the following references: JP 360004561 A ("JP-A '561"); U.S. Patent No. 3,066,112 to Bowen ("Bowen"); U.S. Patent No. 4,544,359 to Waknine ("Waknine"); U.S. Patent No. 4,764,497 to Yuasa et al. ("Yuasa"); U.S. Patent No. 6,586,483 to Kolb et al. ("Kolb"); U.S. Patent No.

6,387,981 to Zhang et al. ("Zhang"); and U.S. Patent No. 4,180,911 to Bullock ("Bullock"). Applicants respectfully traverse these rejections.

None of these references teach or suggest silica particles in the form of chains having lengths of about 5 to about 400 nanometers, and further having at least one crystalline phase as required by the claims. Because the cited references fail to teach or suggest all the elements, they cannot anticipate nor render obvious the present claims.

To anticipate a claim, a reference must disclose each and every element of the claim. *Lewmar Marine v. Varient Inc.*, 3 U.S.P.Q.2d 1766 (Fed. Cir. 1987).

For an obviousness rejection to be proper, the Examiner must meet the burden of establishing a *prima facie* case of obviousness, i.e., that all elements of the invention are disclosed in the prior art. *In re Fine*, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988).

JP-A '561 discloses a dental filler comprising silica having a particle diameter of 0.1 to 1.0 micrometers (100 to 1000 nanometers). (JP-A '561 Abstract) JP-A '561 fails to disclose silica particles in the form of chains having lengths of about 5 to about 400 nanometers.

Bowen discloses a dental filler comprising fused silica that can pass through a 325 sieve and therefore having a diameter smaller than 45 micrometers (45,000 nanometers). (Bowen Col. 2, ll. 18-20) Bowen fails to disclose silica particles in the form of chains having lengths of about 5 to about 400 nanometers.

Waknine discloses a dental filler comprising silica with an average particle size of 0.01 to 0.05 micrometers (10 to 50 nanometers). (Waknine Abstract) Waknine fails to disclose silica particles in the form of chains having lengths of about 5 to about 400 nanometers.

Yuasa is directed to an amorphous, spherical inorganic compound having a particle size of 0.1 to 1.0 micrometers (100 to 1000 nanometers). (Yuasa Abstract) The scanning electron micrographs depicted in the Figures disclose agglomerates of silica particles. (Yuasa Figs 1-3) The average diameter of the particles in Fig. 2 appears to be about 4 millimeters. At 20,000x magnification, this translates to a diameter of about 200 nanometers. The agglomerates contain a large number of contiguous silica particles that are much longer than the presently claimed silica chains of about 5 to about 400 nanometers. Therefore, Yuasa fails to disclose silica particles in the form of chains having lengths of about 5 to about 400 nanometers.

Kolb is directed to a foam composition that includes a vehicle and surface-modified nanoparticles disposed in the vehicle. The individual nanoparticles having a particle diameter of less than about 100 nanometers (Kolb Abstract), with preferred diameters from about 3 to about 50 nanometers (col. 1, ll. 48-53). In addition, Kolb discloses that:

> The surface-modified nanoparticles are preferably individual, unassociated (i.e., non-aggregated) nanoparticles dispersed throughout the vehicle and preferably do not irreversibly associate with each other. The term "associate with" or "associating with" includes, for example, covalent bonding, hydrogen bonding, electrostatic attraction, London forces, and hydrophobic interactions.
>
> The surface-modified nanoparticles are selected such that the composition formed therewith is free from a degree of particle agglomeration or aggregation that would interfere with the desired properties of the composition including the ability of the composition to foam.

(Kolb Col. 1, ll. 48-53) Kolb therefore expressly teaches individual particles that do not associate with each other and therefore teaches away from silica in the form of chains.

Zhang is directed to a dental material comprising a hardenable resin, a non-heavy metal oxide particle and a heavy metal oxide. (Zhang Abstract) Zhang discloses that suitable non-heavy metal oxide particles include silica particles that may be aggregated; however, it is preferable that the total aggregate size be less than about 300 nanometers. (Col. 6, ll. 17-44) Zhang discloses that “a filler comprising a substantially amorphous cluster of non-heavy metal oxide and a heavy metal oxide” can also be used. (Col. 14, ll. 10-20) The amorphous cluster has an average diameter of less than about 5 micrometers. Zhang further discloses that “[b]y ‘substantially amorphous’ it is meant that the clusters are essentially free of crystalline structure.” (Col. 14, ll. 32-33) Zhang therefore fails to disclose silica particles in the form of chains and expressly teaches away from the silica chains having a crystalline phase.

Zhang further discloses that suitable heavy metal oxide particles include zirconia particles that may be in the form of a sol. (Col. 6, line 51 to Col. 7, line 3) Zhang discloses that the zirconia particles in the sols are highly crystalline and that, in the zirconia sols, the zirconia particles have a crystallinity index of about 0.65 or greater. (Col. 7, ll. 33-50) Zhang therefore discloses a heavy metal oxide particle that is highly crystalline but fails to disclose a chain of silica particles having a crystalline phase.

Bullock is directed to the use of a cyanoacrylate resin and a silane-treated inorganic powder in direct bonding mount/bracket structures to teeth. (Bullock Abstract) Bullock discloses various silanes, not silica particles. (Col. 4, line 62 to Col. 5, line 15)

In direct contrast to the above references, the present claims require silica particles in the form of chains having lengths of about 5 to about 400 nanometers, and further having at least one crystalline phase. As disclosed in the specification, the filler is produced by a unique process that involves the steps of drying, heating, and preferably silanizing an aqueous or organic sol of silica particles to form a filler material referred to hereinafter as the "sol derived filler." (¶ [0030]) Commercially available colloidal sol can be treated to provide bound silica particles in the form of chains having lengths of about 5 to about 400 nanometers, and further having at least one crystalline phase. (¶¶ [0030] – [0031]) Without being bound by theory, it is hypothesized that the chains of bound silica improve fracture resistance compared to discrete, particulate materials. As described in Example 8, the original colloidal sol is amorphous while the claimed fillers comprise chains of bound silica contain crystalline phases. (¶¶ [0061]-[0063]; Fig. 1). Because none of the references disclose all limitations, the cited references cannot anticipate nor render obvious the present claims.

Even where a *prima facie* case of obviousness exists, obviousness may be rebutted by a showing of "unexpected results", i.e., comparative test data showing that the claimed invention possesses unexpectedly improved properties, or properties that the prior art does not have. *In re Dillon*, 919 F.2d 688, 692-93, 16 U.S.P.Q.2d 1897, 1901 (Fed. Cir. 1990). The results must be of both statistical and practical significance. *Ex parte C*, 27 U.S.P.Q.2d 1492, 1497 (Bd. Pat. App. & Int. 1993).

As disclosed in the specification, the claimed filler provides unexpectedly improved wear as compared to commercially available fillers. (¶ [0060]; Table 5) A nanohybrid filler composite "PCBisGMA composition" that comprised a barium zirconate silicate made in accordance with Example 8 below (Powder 2) was compared to two commercially available composites, Esthet-X® (Dentsply/Caulk) and Z250 (3M). (Table 4) The results of the generalized wear (surface wear) for PCBisGMA composite exhibited the least amount of wear

(3.8 +/-1.0 millimeters), followed by Z250 (9.8 +/- 0.6 mm), and Esthet-X® (13.1 +/- 5.8 mm). (Table 5) Therefore, PCBisGMA composite comprising silica particles in the form of chains having at least one crystalline phase provided unexpectedly improved wear resistance over commercially available composites. Applicants respectfully submit that the unexpected results provided by the claimed fillers would rebut a *prima facie* case of obviousness, if it existed.

Reconsideration and withdrawal of these rejections are respectfully requested.

It is believed that the foregoing amendments and remarks fully comply with the Office Action and that the claims herein should now be allowable to Applicants. Accordingly, reconsideration and withdrawal of the objections and rejections and allowance of the case are respectfully requested.

If there are any additional charges with respect to this Amendment or otherwise, please charge them to Deposit Account No. 06-1130.

Respectfully submitted,

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